

***Etlingera* Giseke of Java**

A.D. POULSEN

Royal Botanic Garden Edinburgh, 20A Inverleith Row
Edinburgh EH35LR, Scotland

Abstract

Nine species of *Etlingera* Giseke are known in Java, though two of them have not been collected recently. An identification key is given, along with descriptions, illustrations, and notes on local names, uses, and ecology. The conservation status of each species is assessed. Two species remain enigmatic and the remaining seven, including *E. parva*, which is synonymized with *E. brachychila*, are all found in Borneo, Sumatra and/or the Malay Peninsula.

Introduction

The genus *Etlingera* Giseke (Zingiberaceae) is an Indo-Pacific genus especially rich in species in the perhumid forests of Thailand, Malaysia, Indonesia and New Guinea. Many species are useful to man as food, condiment, medicine or as ornamentals. They also play an important role in the understorey as a food source for animals. The leafy shoots can be up to 8 m tall and often dominate gaps in disturbed forests.

In Java, *Etlingera* may be confused with other genera that have radical inflorescences: *Amomum* Roxb., *Hornstedtia* Retz. and *Zingiber* Mill. *Etlingera* is, however, distinguished from all these by having a staminal tube.

Blume (1827), described five ginger species from Java which are included in the present paper as *Etlingera coccinea* (Blume) S. Sakai & Nagam., *E. foetens* (Blume) R.M.Sm., *E. hemisphaerica* (Blume) R.M.Sm., *E. solaris* (Blume) R.M.Sm., an *E. walang* (Blume) R.M.Sm. At that time, *E. elatior* (Jack) R.M.Sm. had already been collected in Sumatra and described. Subsequently, *E. megalochelos* Griff. was described from Peninsular Malaysia (Griffith, 1851) and Valeton (1904) documented its presence in Java with useful information also on other species of *Etlingera* there. Valeton published further observations and clear and informative illustrations in 1906. In 1921, he described what is here included as *E. heyniana* (Valeton) R.M.Sm. and *E. parva* (Valeton) R.M.Sm. Since then no further species of

Etilingera has been described from Java and thus the revision by Bakhuizen f. (1958; 1968) includes a total of nine species. In the present treatment, seven of these at least are good species but two remain somewhat "mysterious".

Material and Methods

Measurements of plants follow Poulsen (2006). Only recent collections are cited in the present paper. As new flowering material will be collected allowing detailed measurements, a wider range can be expected for some of the character measurements included below. This is demonstrated by the variation exhibited by the most commonly collected *E. coccinea*, the species with most collections assessed in the present paper.

Assessments of conservation status were carried out following IUCN (2000), based on current knowledge and using their terminology on categories, criteria and subcriteria.

Key to species of *Etilingera* in Java

1. Ligule 4–8 cm long, deeply bilobed; fruit beaked 7. *E. solaris*
1. Ligule <3.5 cm, $\pm$ entire; fruit rounded, flat-topped or with depressed apex 2
2. Inflorescence spike raised more than 10 cm above ground; peduncle extended above ground, $\pm$ erect 3
2. Inflorescence spike at ground level or partly embedded in soil; peduncle subterranean 4
3. Leaves green beneath; inflorescence erect, 60–200 cm; bracts to 13 cm long, outer ones reflexed when flowering; receptacle extended to 10 cm 3. *E. elatior*
3. Leaves reddish beneath (especially when young); inflorescence erect, 15–100 cm; outer bracts forming a cup-shaped spike not recurved when flowering; receptacle <2cm 5. *E. hemisphaerica*
4. Labellum short (< 15 mm), extended <5 mm beyond stigma; fruit with soft teeth 1. *E. brachychila*
4. Labellum long (> 35 mm), extended >7 mm beyond stigma; fruit smooth, ridged or roughly papillose 5
5. Labellum extended <32 mm beyond anther; filament <1 mm long 4. *E. foetens*
5. Labellum extended >34 mm beyond anther; filament >3 mm long 6

6. Petiole usually absent; dorsal corolla lobe hooded over the anther; labellum yellow with red margin; anther dehiscing from 1.5 mm above base to apex; fruit flat-topped with roughly papillose ridges 2. *E. coccinea*
6. Petiole 1–4 cm; dorsal corolla lobe not covering the anther; labellum red with yellow margin; anther dehiscing in upper half only; fruit top rounded, smooth or with a few warts 6. *E. megaloscheilos*

1. *Etlingera brachychila* (Ridl.) R.M. Sm.

Notes: Roy. Bot. Gard. Edinburgh 43 (1986) 243; Smith, Notes Roy. Bot. Gard. Edinburgh 43 (1986) 452; Poulsen, *Etlingera* of Borneo (2006) 66. **Basionym:** *Hornstedtia brachychila* Ridl., J. Straits Branch Roy. Asiat. Soc. 46 (1906) 239. **Type:** Malaysia, Sarawak, Bau, July 1903, flowering, *H.N. Ridley s.n.* [lecto, K (designated by Turner (2000): 34)].

- *Etlingera parva* (Valeton) R.M. Sm., Notes Roy. Bot. Gard. Edinburgh 43 (1986) 248, **syn. nov.** **Basionym:** *Geanthus parvus* Valeton, Bull. Jard. Bot. Buitenzorg ser. 3, 3 (1921) 145. - *Amomum parvum* (Valeton) Bakhuizen f., Bkn. Fl. Java 18 (1958) 30; Bakhuizen f. in Backer, Fl. Java 3 (1968) 56. **Type:** Indonesia, Java, Cipatuja, Bivak Denu, 450 m, 20 Aug 1913, *C.A. Backer* 8887 (holo, BO).

Rhizome long-creeping (80 cm between neighbouring leafy shoots); stilt roots absent. **Leafy shoot** to 3 m, with up to c. 30 leaves; base to 3 cm in diameter, bright red. Sheath striate, margin membranous and glabrous. Ligule to 9.5 mm, entire, truncate to slightly emarginate, greenish, glabrous, margin membranous. Petiole 10–20 mm, hirsute especially adaxially and at base. **Lamina** oblong to narrowly obovate, to 55 x 9 cm, smooth, green, pale beneath, with 0.5 mm long white hairs with swollen base along midrib and near base above; glabrous beneath; average length to width ratio (4–)6(–8); base rounded to cuneate, $\pm$ unequal; apex acuminate 1.5 cm. **Inflorescence** (including peduncle) to 17 cm, embedded in the soil, arising from base or along rhizome, with up to 29 flowers, 5 open at a time. Peduncle to 10 cm, subterranean, ascending, peduncular bracts to 2.5 x 1.8 cm, base with pale hairs, upper just overlapping the base of the spike. Spike 7 x 3 cm, cylindrical, flowers extended 5 cm above the bracts, length only including bracts: 2.5 cm. Sterile bracts 2, distichous, 2.5 x 1.2 cm, elliptic, $\pm$ acute, brownish, pubescent at base. Fertile bracts 2.2–2.5 x 0.3–0.7 cm, narrowly spatulate, boat-shaped, apex rounded, pale brown, pubescent at very base only. Bracteole 2.1 cm, pale reddish, with two fissures of 0.5–1.5 cm, pubescent near base, apex bilobed with a few hairs. **Flower.** Calyx 4.5–6.1 cm, reaching base of filament shorter than corolla lobes, red, with one fissure of ca 3 cm, glabrous, apex $\pm$ tridentate with 3 mucro <1 mm. Corolla tube 5.7 cm, red, glabrous outside and inside.

Lobes red, with a few hairs near apex; dorsal lobe 19–20 x 6–7 mm, almost reaching middle or apex of anther, elliptic, cucullate, margin inrolled, apex rounded; lateral lobes 20–21 x 5 mm, narrowly elliptic, cucullate, margin inrolled, apex rounded; insertion slightly oblique, diverging, 3 mm below dorsal lobe. Staminal tube 10 mm. Labellum broadly ovate, 3-lobed, 14 x 16 mm, red to dark orange, lateral lobes rigid, erect on either side of the stamen (pushing the dorsal lobe apart and exposing the stamen), margin recurved, especially in the distal part, yellow, central lobe rigid, entire, rounded, red or orange, extended 2.5 mm beyond anther. Stamen 11 mm; filament 4–4.5 mm, with a few hairs on the margin especially near base; anther 7.5 x 3.5–5.5 mm, erect, rectangular, red, slightly wider at apex, apex hairy, anther crest truncate; thecae dehiscent *ca* 3.5 mm in the middle (from 2.5 mm above base to *ca* 1.5 mm below apex), pubescent, especially below the slits. Style *ca* 6.5 cm, hairy dorsally near apex. Stigma 3.5–4 mm wide, transverse narrow-elliptic with scattered hairs, red; ostiole transverse 2 mm, facing downwards. Ovary 4 x 3.5 mm, densely sericeous; epigynous glands 4 mm, deeply lobed, each half irregularly lobed. **Infructescence:** head 6 cm, subglobular, *ca* 16 fruits per head; **fruit** 2.5 x 2.5 cm, pyriform with soft, spiny teeth up to 7 mm long, especially developed on the top, dark purple-brown, pubescent. **Seeds** rounded-angular up to 4 mm across. *Plate 1A.*

Local names and uses: None documented.

Etymology: The epithet refers to the short labellum.

Ecology and habitat: Primary lowland (250–450 m) forest.

Distribution: W Java and Borneo.

Conservation status: EN B1ab (iii). Deforestation seriously threatens the forest in the southern part of Java, including its type locality at Cipatuja. With only one recent collection from one location, despite intensive searching, it is potentially endangered in Java. Valeton noted as early as 1921(b), that this species is 'apparently very rare as are the primaeval forests, its habitat.'

Additional material examined: **Banten Province**, buffer zone of Ujung Kulon NP, Gunung Honje, 250 m, 17 Nov 1996, flowering and fruiting, *Funakoshi IU 19* (E, BO n.v.).

Notes: The collection by Funakoshi is to my knowledge the only one from Java since the type of *E. parva* was collected in 1913, and the first including the infructescence. The material matches the type of *E. brachychila* from

Sarawak very well, except the calyx and corolla tube being slightly longer and the lateral lobe of the labellum being yellow but these characters are still within the range of *E. brachychila* var. *vinosa* A.D. Poulsen — also from Borneo.

Etlingera brachychila is easily distinguished from other Javanese species with their inflorescence at ground level by its poorly developed involucre bracts, short labellum and its conspicuous soft-toothed fruit somewhat resembling an *Amomum*. It resembles two species so far only known from Borneo: *E. aurantia* A.D. Poulsen and *E. kenyalang* A.D. Poulsen & H. Chr. *Etlingera brachychila* is distinguished from the other two by the smaller and fewer sterile bracts which give less support to the spike. The apex of the calyx is less mucronate. Finally, *E. brachychila* differs in its flower colour and the orientation of the lateral lobes of the labellum (reflexed vs. erect or involute).

In Borneo a variety *E. brachychila* var. *vinosa* has a white-waxy sheath and often more or less bullate leaves which are burgundy beneath. In Java, this variation in leaf colour has not been documented and the leaves are only sparsely hairy. Future collections may demonstrate more pubescent leaves like those *E. brachychila* var. *brachychila* in Borneo.

2. *Etlingera coccinea* (Blume) S. Sakai & Nagam.

Edinburgh J. Bot. 60 (2003) 190; Poulsen, *Etlingera* of Borneo (2006) 88. **Basionym:** *Elettaria coccinea* Blume, Enum. Pl. Javae (1827) 53; Hasskarl, Pl. Jav. Rar. (1848) 134; Burt & Smith, Notes Roy. Bot. Gard. Edinburgh 31 (1972) 212. - *Geanthus coccineus* Reinw., *nom. nud.*, Catalogus (1823) 29.

- *Alpinia coccinea* (Blume) D. Dietr., Syn. Pl. 1 (1839) 12. - *Cardamomum coccineum* (Blume) Kuntze, Revis. Gen. Pl. 2 (1891) 686. - *Amomum coccineum* Benth. [Gen. pl. 3 (1883) 644, *nom. inval.*] ex Schumann, Bot. Jahrb. Syst. 27 (1899) 305; Valeton, Bull. Inst. Bot. Buitenzorg 20 (1904) 44; Valeton, Icon. Bogor. 2 (1906) t. 156, t. 157 figs. 21–22; Bakhuizen f., Bekn. Fl. Java 18 (1958) 34; Bakhuizen f. in Backer, Fl. Java 3 (1968) 57; van Steenis, Mt. Flora of Java, (1972) pl. 57: 2. - *Achasma coccineum* (Blume) Valeton, Bull. Inst. Bot. Buitenzorg 20 (1904) 93; Heyne, Nuttige pl. Nederl. Indië 1 (1927) 489. **Type:** Probably Java, *C.G.C. Reinwardt s.n.*, bar code L0193260, accession number 905339126, including only fertile material to the right of the leaf (lecto, L, designated by Sakai & Nagamasu, 2003).

- *Achasma macrocheilos* Griff., Not. Pl. Asiat. 3 (1851) 429, Ic. Pl. Asiat. 3 (1851) t. 357. - *Amomum macrocheilos* (Griff.) Baker, Fl. Brit. India 6 (1892) 235. - *Hornstedtia macrocheilos* (Griff.) Ridl., J. Straits Branch Roy. Asiat. Soc. 32 (1899) 147; Schumann, Pflanzenr. IV, 46 (1904) 198; Ridley, Matr. Fl.

Mal. Penin. 2 (1907) 39; Ridley, Fl. Mal. Penin. 4 (1924) 271. **Type:** Malaysia, Malacca, Ayer Punnus, *W. Griffith s.n.* (not seen, specimen probably lost).

- *Amomum gomphocheilos* Baker, Baker, Fl. Brit. India 6 (1892) 236. **Type:** Malaysia, Perak, *H. H. Kunstler 1897* (holo, K).

- *Hornstedtia punicea* (Roxb.) K. Schum., Pflanzenr. IV, 46 (1904) 197, pro parte, not including type: *Etilingera punicea* auct. non (Roxb.) R.M. Sm.: Smith, Notes Roy. Bot. Gard Edinburgh 43 (1986) 443; Cowley in Coode et al., Checklist Pl. Brunei (1996) 419; Keng et al., Concise Fl. Singapore 2 (1998) 57; Khaw, Gard. Bull. Singapore 53 (2001) 229.

- *Hornstedtia winkleri* Ridl., Bot. Jahrb. Syst. 44 (1910) 530. **Type:** Indonesian Borneo, SE of Sungai Sibak in Gunung Benanpin, 12 Aug 1908, flowering, *Hubert J.P. Winkler 3175* (holo, WRS�).

Rhizome long-creeping (70–100 cm between neighbouring leafy shoots), 2.5–4 cm diam., scales to 6 cm long, ensheathing. **Leafy shoot** 5–8 m, with up to to 32 leaves; base to 8–12 cm diam., green or reddish brown. Sheath green, yellowish green or brownish, striate, $\pm$ reticulate (especially when young), glabrous or slightly pubescent (especially on cross ribs), margin ciliate. Ligule 10–15 mm, entire, green to purplish brown, $\pm$ pubescent. **Lamina** sessile (rarely with a 1–2 cm, petiole-like, winged-attenuate base), oblong to narrowly obovate, to 130 x 23 cm, mid- or dark green, young leaf reddish brown beneath, glabrous (rarely pubescent beneath); average length to width ratio 4–6; base cuneate, sometimes irregularly winged; apex acuminate 1.5 cm. **Inflorescence** (including peduncle) to 47 cm, arising from the rhizome near base of leafy shoot, with 15–27 flowers, 4–14 open at a time. Peduncle 2–33 cm, subterranean, peduncular bracts cream to pale brown. Spike 8–10 x 3–5 cm, ovoid to cylindrical, flowers extending 2–4 cm above the bracts, length only including bracts: 6–8 cm. Sterile bracts: 4–5 forming a dense support, distichous (uppermost one sometimes in the middle), 4–6 x 1.5–3 cm, $\pm$ pale reddish brown or cream with $\pm$ reddish apex and pale brown margin, pubescent near base. Fertile bracts 4–7 x 0.7–1.5 cm, spatulate, membranous, cream, pale red or brown especially at apex, pubescent especially near base and apex. Bracteole 3.8–5 cm, pale red at least at apex, with two fissures of 6–15 mm, $\pm$ pubescent, apex 2-toothed, ciliate. **Flower:** calyx 7–8.3 cm, reaching base of anther and shorter than corolla lobes, pale pink with darker apex, with one fissure of 2.5–4 cm, glabrous, apex 3-toothed. Corolla tube 4.9–6.8 cm, cream, glabrous outside, tube inside with an irregular band c. 1 cm 2 cm below labellum; lobes reddish pink, glabrous, reaching beyond anther; dorsal lobe 21–31 x 9–11 mm, elliptic,

apex rounded, hooded over the anther; lateral lobes 21–25 x 4–7 mm, elliptic, apex rounded, insertion oblique and converging; staminal tube 4–12 mm. Labellum 3-lobed, 50–65 x 21–25 mm, red with yellow in centre, glabrous, lateral lobes folded over stamen, pale to dark red at margin, margin finely plicate, central lobe c. 30 x 16 mm, spatulate, emarginate to 15 mm, rarely entire, dark red extended 40–50 mm beyond anther. Stamen 12 mm long: filament 3–7 x 3.5–5 mm (widest at base), white to pale red; anther 9–10 x 2.5–5.5 mm (widest at apex), emarginate to 2.5 mm, angled 120°, pink; thecae dehiscent from 1.5 mm above base to apex, glabrous. Style 8–8.5 cm, sparsely pubescent, flexistylous. Stigma 2.5 mm wide, white or pale pink, triangular to heart-shaped, ± hairy, ostiole apical, transverse. Ovary 5 mm long, densely pubescent; epigynous glands 5–7 mm long, bipartite, linear. **Infructescence:** head to 12 cm, globose, bracts persistent, 5–15 fruits per head, **fruit** 4.5 x 3.5 cm, pyriform, flat-topped with irregular radiating roughly papillose ridges up to 6 mm high, brownish (red when young), pubescent. **Seeds** 2–3 mm across. *Plate 1B.*

Local names and uses: Blume (1827) listed *tepus*, *tepus gede*, and *mancirian* (Sundanese). Valeton (1904) mentioned that *tepus bener* (genuine) and *tepus leuweung* (forest or wood) as names for subspecies with an entire or emarginate apex to the labellum, respectively. Heyne (1927) also mentioned *tepus bener* but specified that *mancirian* is the name of the flower, and *rongod* refers to the fruit.

The young leafy shoot and the fruits are edible (Poulsen *et al.* 2282). Shoot tastes cabbage-like when young; bitter when old. Even though it is often considered useful I never came across it being planted and cultivated in Java.

Etymology: *Coccinea* means scarlet.

Ecology and habitat: Old field edges, in traditional home gardens (but not planted), secondary forests, or in gaps or near streams of primary forests at 40–1650 m. Valeton (1904) noted that the seeds are frequently dispersed by animals that leave behind a big hole in the top of the empty fruit.

In Sumatra and Borneo, *E. coccinea* is pollinated by bees or spiderhunters (Kato *et al.*, 1993; Sakai *et al.*, 1999). Fruit eaten by rodents.

Distribution: Thailand, Peninsular Malaysia, Singapore, Sumatra, Java and Borneo.

Conservation status: LC (least concern), because of its wide distribution and persistence in very disturbed habitats.

Additional material examined: **Banten Province:** bufferzone of Ujung Kulon NP, Gunung Cibiug, 3 km E of Tamanraya village ($6^{\circ}47'S$ $105^{\circ}32'E$), 130 m, 27 Apr 2005, flowering and fruiting, *Poulsen et al.* 2343 (AAU, BO, E). **West Java Province:** Gunung Salak ($6^{\circ}40'S$ $106^{\circ}44'E$), 950 m, 28 Sep 2003, flowering, *Poulsen et al.* 2233 (BO); Halimun NP, Citalahab ($6^{\circ}44'S$ $106^{\circ}32'E$), 1100 m, 20 Mar 2004, flowering and fruiting, *Poulsen et al.* 2282 (AAU, BO, E); Gunung Kancana, 2 km WSW of Parabuan village ($6^{\circ}55'S$ $107^{\circ}03'E$), 950 m, 27 Mar 2004, flowering, *Poulsen et al.* 2294 (AAU, BO); Cisarakan ($7^{\circ}05'S$ $106^{\circ}35'E$), 500 m, 10 Aug 2006, flowering, *Poulsen et al.* 2457 (BO); Cikaso ($7^{\circ}22'S$ $106^{\circ}37'E$), 40 m, 11 Aug 2006, flowering, *Poulsen et al.* 2458 (BO, E); Gunung Cikuray ($7^{\circ}19'S$ $107^{\circ}54'E$), 1250 m, 13 Aug 2006, flowering, *Poulsen et al.* 2463 (BO, E).

Notes: In Java, *E. coccinea* can most easily be confused with *E. megalochilos*. *Etlingera coccinea* differs in its (most often) sessile leaves, absence of tufts on the apex of the calyx, the broad, pink dorsal corolla lobe hooded over the stamen, the long-elongate labellum with a broad yellow centre and red margin and thecae dehiscing almost to base. The margins are inrolled and like a tube so that the red at first glance appears to be in the centre of the labellum (like in *E. megalochilos*).

Most often the leaf of *E. coccinea* is glabrous but not always. During my recent survey, one plant was collected in which the lamina was pubescent beneath (*Poulsen et al.* 2457) and *E. megalochilos* also varies regarding the indumentum beneath the lamina. Thus as demonstrated in the Bornean revision of *Etlingera* (Poulsen, 2006) indumentum is not a completely reliable character.

Schumann (1904) regarded *E. coccinea* as a synonym of *E. punicea*, and therefore the latter name was used by Smith (1986) and others. This misconception was finally sorted out by Sakai & Nagamasu (2003).

Valeton (1904) described beautifully how the flowers in one inflorescence opened, in up to three circles of up to 15 flowers, each lasting only one day; he obviously took great care in making precise observations of live plants of *Etlingera* in Java. Valeton (1904) further mentioned that the 'subspecies' (cf. etymology above) with an entire apex to the labellum is much more common than the emarginate one, whereas I found the opposite to be the case. In any case, I do not see any reason to formally recognize this variation in two subspecies.

The local name in Java, *tepus* (Sundanese), is also used in Borneo by many tribes (Poulsen, 2006). Often peoples in Borneo use a generic name for all gingers that seems to be derived from that. The giant form that I collected in several places in Borneo is most similar to wild plants in Java,

such as those on Gunung Salak. All these lack a strong smell. Many local names in Borneo include an epithet that refers to the distinct smell. Some forms may have been selected over centuries and taken into cultivation. These plants are often smaller, but I did not find any floral measurements justifying the recognition of the smaller and smellier plants even at a lower taxonomic rank.

In this context it is interesting that the enigmatic *Etlingera walang* (Blume) R.M. Sm. is considered a very smelly plant. New collections in Java of a smelly *Etlingera coccinea* may provide the necessary evidence for establishing this synonymy.

3. *Etlingera elatior* (Jack) R.M. Sm.

Notes Roy. Bot. Gard. Edinburgh 43 (1986) 244; Smith, Notes Roy. Bot. Gard. Edinburgh 43 (1986) 442; Lim, Folia Malaysiana 1 (2000) 4; Lim, Folia Malaysiana 2 (2001) 168; Khaw, Gard. Bull. Singapore 53 (2001) 206; Sakai & Nagamasu, Edinburgh J. Bot. 60 (2003) 192452; Poulsen, Etlingera of Borneo (2006) 111. **Basionym:** *Alpinia elatior* Jack, Descriptions of Malayan plants 2 (7) (1822) 2; Miquel, Fl. Ned. Ind., 1. Suppl. (1861) 273. - *Nicolaia elatior* (Jack) Horan., Prodr. Monogr. Scitam. (1862) 32; Burt & Smith, Notes Roy. Bot. Gard. Edinburgh 31 (1972) 210, fig. 17B. **Type:** Nias Island or Ayer Bangy, W coast of Sumatra, W. Jack s.n. 1818 (specimen lost). *Bunga kenchong* (Malay).

- *Geanthus speciosus* Reinw., Catalogus (1823) 29, *nom. nud.*

- *Diracodes javanica* Blume, Enum. Pl. Javae (1827) 55. - *Alpinia javanica* (Blume) D. Dietr., Syn. Pl. 1 (1839) 13. - *Alpinia acrostachya* Steud., Nomencl. Bot. 2 (1840) 62. - *Alpinia diracodes* Loes., Nat. Pflanzenfam. ed. 2, 15, A (1930) 614. **Type:** Java, Hariang, C.G.C. Reinwardt s.n., bar code L0041105 (holo, L).

- *Elettaria speciosa* Blume, Enum. Pl. Javae (1827) 51; Hasskarl, Pl. Jav. Rar. (1848) 133; Valetton, Bull. Inst. Bot. Buitenzorg 20 (1904) 29.

- *Alpinia speciosa* (Blume) D. Dietr., Syn. Pl. 1 (1839) 13. - *Nicolaia speciosa* (Blume) Horan., Prodr. Monogr. Scitam. (1862) 32; Valetton, Bull. Jard. Bot. Buitenzorg ser. 3, 3 (1921) 138; Heyne, Nuttige pl. Nederl. Indië 1 (1927) 488; Bakhuizen f., Bekn. Fl. Java 18 (1958) 47; Bakhuizen f. in Backer, Fl. Java 3 (1968) 64. - *Phaeomeria speciosa* (Blume) Koord., Exkurs.-Fl. Java 1 (1911) 332; Merrill, Enum. Phil. Pl. 1 (1925) 241; Holttum, Gard. Bull. Singapore 13 (1950) 181. **Type:** Java, in forest near Kapang Dungan, H. Kuhl & J.C. van Hasselt s.n., bar code L0193778 (lecto, L, designated by Sakai & Nagamasu, 2003).

- *Alpinia magnifica* Roscoe, Monandr. Pl. Scitam. (1828) t. 75; Hooker, Bot. Mag. 59 (1832) t. 3192. - *Bojeria magnifica* Raf., Fl. Tellur. (1836) 50, *nom. inval.* - *Phaeomeria magnifica* Lindl., Intr. Nat. Syst. Bot., ed. 2 (1836) 446, *nom. inval.* - *Nicolaia imperialis* Horan., Prodr. Monogr. Scitam. (1862) 32, t. 1, *nom. inval.* - *Amomum magnificum* (Roscoe) Benth. [Gen. Pl. 3 (1883) 644, *nom. inval.*] ex Schumann, Bot. Jahrb. Syst. 27(1899) 307; Valeton in Merrill, Interp. Herb. Amboin. (1917) 159. - *Cardamomum magnificum* (Roscoe) Kuntze, Revis. Gen. Pl. 2 (1891) 687. - *Hornstedtia imperialis* (Horan.) Ridl., J. Straits Branch Roy. Asiat. Soc. 32 (1899) 148. - *Nicolaia magnifica* (Roscoe) K. Schum. ex Valeton, Bull. Inst. Bot. Buitenzorg 20 (1904) 35. - *Phaeomeria magnifica* (Roscoe) K. Schum., Pflanzenr. IV, 46 (1904) 262; Loesener, Nat. Pflanzenfam. ed. 2, 15A (1930) 594. - *Phaeomeria imperialis* Lindl. ex Ridl., Fl. Malay Penins. 4 (1924) 272; Elmer, Leaf. Phil. Bot. 8 (1915) 2907. **Type:** Originally from Mauritius, 1825, *C. Telfair s.n.*, cultivated (holo, K).

- *Nicolaia intermedia* Valeton, Bull. Jard. Bot. Buitenzorg ser. 3, 3 (1921) 133. **Type:** Possibly from Java, *Anon. s.n. (HB XI B IV 101)*, cultivated in Bogor (holo, BO).

Rhizome short-creeping. **Leafy shoot** to 6 m, several together in a loose clump; base to 6 cm in diameter, sheath pubescent at the very base, $\pm$ reddish. Sheath green, striate when dry, glabrous, pruinose when young. Ligule to 15 mm, entire, obtuse, green, glabrous, margin ciliate. Petiole to 25 mm. Lamina oblong, to 80 x 20 cm, yellowish or mid-green, pale green beneath; average length to width ratio 3.5–6.5; base truncate, $\pm$ unequal; apex acuminate to c. 1 cm. **Inflorescence** (including peduncle) to 2 m, erect from base of leafy shoot, receptacle elongate to 10 cm in old inflorescences, with up to at least 320 flowers, 10–20 open at a time. Peduncle 0.6–2 m, peduncular bracts to 22 x 2.5 cm (upper, which play the same role as the lower sterile bracts), distichous, green to yellowish green, pubescent near base. Spike to 15 x 15 cm, ovoid, flowers not extended above bracts. Sterile bracts numerous, spirally arranged, lower to 13 x 4.5 cm, lowest one biggest, distinctly reflexed, dark or pale pink with pale (sometimes almost white) margin; turning brown with age, pubescent near base. Fertile bracts 2.5–7 x 0.7–2.5 cm, oblong, concave, apex obtuse, sometimes inrolled, red to pale pink with a white margin, glabrous, apex with ciliate margin. Bracteole 2.2–3.1 cm, membranous, transparent, pale pink to red at apex, with two fissures of 0.3–1.5 cm, glabrous, apex 2-toothed, tufted. **Flower.** Calyx 3–3.5 cm, reaching at least base of anther, pink, fissured 2 cm, glabrous; apex irregularly 3-toothed, tufted. Corolla tube 2.7–2.8 cm, dark red at apex, sericeous ventrally below lobes, tube inside with two elongate, densely

V-shaped hairy cushions 5 mm wide, c. 1 cm below labellum and coinciding $\pm$ with attachment of the lobes on the outside, pubescent dorsally towards filament. Lobes dark pink, glabrous with ciliate apex; dorsal lobe 21–23 x 5.5–6 mm, reaching slightly beyond stigma, narrowly elliptic to spatulate, cucullate, apex obtuse, tufted; lateral lobes 22–24 x 3.5–4 mm, narrowly elliptic to spatulate, cucullate, apex obtuse, slightly emarginate, with ciliate tuft; attached straight, 2 mm below dorsal lobe. Staminal tube 10–12 mm; labellum $\pm$ entire, 20 x 18 mm, red with yellow margin, roughly papillose in centre extending into the corolla tube, lateral lobes $\pm$ erect, meeting above stamen, margin slightly recurved, central lobe slightly emarginate, extended c. 10 mm beyond anther, margins slightly recurved. Stamen 10–11 mm long; filament 2.5–3 x 2.5 mm, white, papillose inside; anther 8–9 x 3.5 mm, $\pm$ oblong, slightly wider at apex, erect, white to pale red, anther crest short; thecae dehiscing in upper 1/2–2/3 almost to apex, pubescent, base with long tuft. Style 3.7–3.8 cm, with scattered long hairs. Stigma 3 mm wide, dark red, club-shaped; ostiole round, facing downwards. Ovary 4–5.5 x 5 mm, sericeous; epigynous gland 4 mm, slightly bilobed, roughly papillose. **Infructescence** remaining erect, head 10–12 (or longer) x 5–9 cm, the lower bracts rot and are not conspicuous, 67–100 fruits per head; **fruit** 2.5–3.5 x 1.5–2.5 cm, pyriform, angled, top rounded, not beak-like, calyx $\pm$ persistent, to 3 mm, reddish, pink, pale orange-red or maroon, pubescent. **Seeds** to 4 mm across, rounded-angular. *Plate 1C*.

Local names and uses: Blume (1827) listed the following names *konje*, *hunje*, *hunje-reuma* (Sundanese). Heyne (1927) mentioned that *rombe* refers to the young inflorescence and *combrang* (*tjombrang* orth. var.) to the flowers (also Sundanese) and in Javanese or *kecombrang*, *cumbrang*, *combrang*.

Hondje hedjo (Sundanese; *hedjo* means green referring to the colour of the leaves as opposed to *E. hemisphaerica* that has reddish leaves beneath; Poulsen *et al.* 2293).

Edible leafy shoots, flowers, and fruits. Often sold at the market.

Etymology: The epithet refers to the raised inflorescence.

Ecology and habitat: It is difficult to say with certainty if *Etlingera elatior* is native to Java as it has been cultivated there for a very long time. Bakhuizen f. (1968) listed its occurrence in primary and secondary forests to 1200 m, though I am yet to encounter it in natural vegetation in Java.

Distribution: Widespread in the tropics (Poulsen, 2006).

Conservation status: LC (Least Concern). Not threatened.

Additional material examined: **West Java Province**, Gunung Kancana, 800 m, W of Parabuan village (6°54'S 107°03'E), 800 m, 26 Mar 2004, flowering, Poulsen *et al.* 2293 (AAU, BO).

Notes: *Etlingera elatior* is most similar to *E. hemisphaerica* but the most striking differences between the two is the the longer and reflexed lower bracts in the involucre of *E. elatior*. Furthermore, the inflorescence is usually more than 1 m (vs. <1 m), the receptacle extends to 10 cm (vs. <2 cm), and the fruit is reddish (not green).

The description by Bakhuizen f. (1968) mentions that the leaves can be purple beneath which could resemble those of *E. hemisphaerica*. This I have only observed in Java in cultivated plants. The colour of the bracts of *E. elatior* can vary from deep blood-red to white (Poulsen, 2006). In Java, some of the inflorescences sold in the market are deep red whereas the more typical ones are pink.

In rare cases, such as the type of *Diracodes javanica* Blume, the inflorescence in *E. elatior* appears terminally on a leafy shoot.

4. *Etlingera foetens* (Blume) R.M. Sm.

Etlingera foetens (Blume) R.M. Sm., Notes Roy. Bot. Gard. Edinburgh 43 (1986) 245; Poulsen, *Etlingera* of Borneo (2006) 132. **Basionym:** *Elettaria foetens* Blume, Enum. Pl. Javae (1827) 52. *Alpinia foetens* (Blume) D. Dietr., Syn. Pl. 1 (1839) 12. *Cardamomum foetens* (Blume) Kuntze, Revis. Gen. Pl. 2 (1891) 686. *Amomum foetens* (Blume) Benth. [Gen. Pl. 3 (1883) 644, *nom. inval.*] ex Schumann, Bot. Jahrb. Syst. 27 (1899) 322; Valeton, Bull. Inst. Bot. Buitenzorg 20 (1904) 44; Valeton, Icon. Bogor. 2 (1906) t. 157 figs. 16–17, 23, t. 154 fig. 18, t. 162 figs. 10–15; Bakhuizen f., Bekn. Fl. Java 18 (1958) 34; Bakhuizen f. in Backer, Fl. Java 3 (1968) 58. *Achasma foetens* (Blume) Valeton, Bull. Inst. Bot. Buitenzorg 20 (1904) 93; Heyne, Nuttige pl. Nederl. Indië 1 (1927) 489. *Hornstedtia foetens* (Blume) K. Schum., Pflanzenr. IV, 46 (1904) 200. *Geanthus foetens* (Blume) Valeton ex A.W.K. de Jong, Jaarb. Dep. Landb. Nijverh. Handel Ned.-Indië 1917 (1919) 78. **Type:** *C.L. von Blume s.n.*, bar code L0193175 (holo L).

- *Etlingera triorgyalis* auct. non (Baker) R.M. Sm.; *Etlingera triorgyalis* vel sp. aff.: Smith, Notes Roy. Bot. Gard Edinburgh 43 (1986) 443; Sakai & Nagamasu, Edb. J. Bot 60 (2003) 212.

Rhizome long-creeping (up to 80 cm between shoots), stout, c. 2 cm in diameter, scales large (to 9 cm), cream, pale brown to reddish. **Leafy shoot** 2–5 m, leafless c. 1 m, with up to 22 leaves; base to 7.5 cm in diameter,

reticulate with distinct and tufted cross bars, green or greenish brown. Sheath mid- to yellow-green, roughly reticulate, $\pm$ pubescent, margin ciliate. Ligule 15–21 mm, entire, green, pubescent, margin densely tufted ciliate at apex. Petiole to 25 mm, pubescent. Lamina narrowly obovate, to 83 x 14 cm, slightly plicate, green, glabrous above (rarely scabrid in centre near base), pubescent beneath; average length to width ratio 4.5–6; base cuneate, $\pm$ unequal; apex acuminate to 2 cm. **Inflorescence** (including peduncle) (10–)18–25 cm, with 18–24 flowers, 2–7 open at a time. Peduncle (3–)9–13 cm, subterranean, peduncular bracts to 5 x 5 cm. Spike 6–9 x 3–5 cm, ovate-cylindrical, flowers extended 0–1 cm above the bracts, length only including bracts: 8–9 cm. Sterile bracts 5–7, distichous, lower 4.5–5.5 x 4.5–5.5 cm, upper to 8.5 x 2.3–3.5 cm, ovate to broadly spatulate (upper), rigid, mucronate, red, pubescent in lower third. Fertile bracts 6.5–8 x 0.7–1.5 cm, spatulate, membranous, translucent white with pinkish apex, densely pubescent. Bracteole 5.4–6.5 cm, whitish with pink apex, with two fissures of *c.* 1 and *c.* 1.5 cm, densely pubescent; apex bifid both lobes emarginate, aristate 3 mm, densely hairy. **Flower**: Calyx 7–7.5 cm, reaching anther, $\pm$ as long as corolla lobes or slightly shorter, membranous, fissured 3–3.5 cm, densely pubescent; apex irregularly 3-fid, aristate. Corolla tube 5.8–6.7 cm, whitish with pink apex, glabrous or with scattered hairs, inside with 5 mm band of scattered hairs *c.* 10 mm below labellum. Lobes pale red with bright red apices, with a few hairs; dorsal lobe 20–22 x 6–7 mm, reaching middle or apex of anther, spatulate, cucullate, margin constricted; lateral lobes 18–22 x 5–6 mm, spatulate, $\pm$ cucullate; attached obliquely, 0–2 mm higher or at same level as dorsal lobe. Staminal tube 11–12 mm; labellum 3-lobed, 38–43 x 17 mm, deep red with darker red and roughly papillose centre, glabrous, lateral lobes erect, margins thin, involute over stamen, central lobe broadly spatulate, 14–18 mm wide, $\pm$ emarginate, apex extended 27–31 mm beyond anther; anther subsessile, 10–11.5 x 2.5–5 mm, widest at apex, $\pm$ erect, pale pink or red, darker at crest; thecae dehiscing in upper 60%, few hairs at the base, especially dorsally. Style 6.8–7.3 cm, hairy dorsally in upper part. Stigma 4 mm, rounded-triangularly to pentangular with a rounded back, pale red or red; ostiole transverse, 2 mm, facing downwards. Ovary 5–6 mm, densely pubescent; epigynous glands 6.5 mm, bipartite, apices tooth-shaped. **Infructescence** half embedded in the soil, head 4.5 x 3–8 cm, subglobose, bracts shredding, to *ca* 22 fruits per head; **fruit** 2.2–3 x 2.5 cm, subglobular, angled, with fine, papillose ridges, pink, densely pubescent. **Seeds** to 3 mm across, rounded. *Plate 1D.*

Local names and uses: *Tepus sigung* (Sundanese). This name was recorded by Blume (1827) and confirmed when *Poulsen et al.* 2296 was collected in 2004. According to Valetton (1904), *sigung* (or *sigeung*) is the local name for the

Javan Skunk Marten (possibly *Mydaeus javanensis*) which is infamous for its revolting smell, resembling asafoetida and fennel. The fruits are eaten.

Etymology: The epithet means smelly.

Ecology and habitat: Lowland primary or disturbed forests at banks of rivers or streams to 950 m.

Distribution: Borneo, Java, Sumatra and possibly Peninsular Malaysia and Thailand.

Conservation status: EN B1ab(iii). Deforestation seriously threatens the forest in Java – especially in the lowlands. Already Bakhuizen f. (1968) noted that *E. foetens* was rare and, during my surveys from 2003–2006, I only found one sterile plant.

Additional material examined: **West Java Province**, Gunung Kancana, 2 km WSW of Parabuan village (6°55'S 107°03'E), 950 m, 27 Mar 2004, sterile, Poulsen *et al.* 2296 (AAU, BO).

Notes: *Etlingera foetens* is easily recognized by its deeply reticulate and broad leaf bases, plain red flowers where the dorsal lobe of the corolla does not cover the anther, the elongate and broad labellum and the strong smell when crushed.

I have not seen flowering plants of *E. foetens* in Java and thus the description of floral characters are based on Bornean measurements, which, however, match nicely those in the Flora of Java (Bakhuizen f., 1968). In Borneo, all flowers observed so far are uniformly red whereas in Sumatra the lateral margins of the labellum are occasionally slightly yellow. Thus it would not be surprising if flowers in Java showed similar variation.

As discussed in detail by Poulsen (2006), *E. triorgyalis* (Baker) R.M. Sm. is similar to *E. foetens*. It is sometimes a taller plant (8 m vs. 5 m) and has larger sterile bracts (with recurved apices making the inflorescence cyathiform), and a greater number of flowers per inflorescence. In addition, several floral measurements (calyx, corolla, and width of apical lobe of the labellum) are larger (Khaw, 2001). These characters seem to separate the material from Peninsular Malaysia (including the type of *E. triorgyalis* from Perak) from that of Java, Borneo and Sumatra.

5. *Etlingera hemisphaerica* (Blume) R.M. Sm.

Etlingera hemisphaerica (Blume) R.M. Sm., Notes Roy. Bot. Gard. Edinburgh 43 (1986) 245. **Basionym**: *Elettaria hemisphaerica* Blume, Enum. pl. Javae (1827) 51. *Alpinia hemisphaerica* (Blume) D. Dietr., Syn. pl. 1 (1839) 13.

Nicolaia hemisphaerica (Blume) Horan., Prodr. Monogr. Scitam. (1862) 32; Bakhuizen f., Bekn. Fl. Java 18 (1958) 46; Bakhuizen f. in Backer, Fl. Java 3 (1968) 63. *Cardamomum hemisphaericum* (Blume) Kuntze, Revis. gen. pl. 2 (1891) 686. *Amomum hemisphaericum* (Blume) K. Schum., Bot. Jahrb. Syst. 27 (1899) 307. *Phaeomeria hemisphaerica* (Blume) K. Schum., Pflanzenr. IV, 46 (1904) 263. **Type:** *C.L. von Blume s.n.* (holo, L), Java.

- *Elettaria anthodioides* Teijsm. & Binn., Ned. Kruidk. Arch. 3 (1855) 392. *Amomum anthodioides* (Teijsm. & Binn.) Koord., Meded. Lands Plantentuin 19 (1898) 318. *Phaeomeria anthodioides* (Teijsm. & Binn.) Koord., Exkurs.-Fl. Java 1 (1911) 332. *Nicolaia anthodioides* (Teijsm. & Binn.) Valeton, Bull. Jard. Bot. Buitenzorg ser. 3, 3 (1921) 128. **Type:** *J.E. Teijsmann s.n.* (iso, P).

- *Elettaria atropurpurea* Teijsm. & Binn., Natuurk. Tijdschr. Ned.-Indië 24 (1862) 327. *Phaeomeria atropurpurea* (Teijsm. & Binn.) K. Schum., Pflanzenr. IV, 46 (1904) 266. *Nicolaia atropurpurea* (Teijsm. & Binn.) Valeton, Bull. Jard. Bot. Buitenzorg ser. 3, 3 (1921) 128; Heyne, Nuttige pl. Nederl. Indië 1 (1927) 487. **Type:** *J.E. Teijsmann s.n.*

- *Nicolaia sanguinea* Valeton, Bull. Inst. Bot. Buitenzorg 20 (1904) 36. *Phaeomeria sanguinea* (Valeton) Koord., Exkurs.-Fl. Java 1 (1911) 332. **Type:** *Anon. s.n.* (BO).

- *Nicolaia rostrata* Valeton, Bull. Jard. Bot. Buitenzorg ser. 3, 3 (1921) 134. *Phaeomeria rostrata* (Valeton) Loes., Nat. Pflanzenfam. ed. 2, 15, A (1930) 594. **Type:** *H.A.B. Bünne Meyer 809* (holo BO), Gunung Talamau ("Ophir")

- *Nicolaia rostrata* var. *talangensis* Valeton, Bull. Jard. Bot. Buitenzorg ser. 3, 3 (1921) 135. **Type:** *H.A.B. Bünne Meyer 5298, 5299, 5431* (syn, BO), West Sumatra, Gunung Talang.

Rhizome in clump. Leafy shoot 3–6 m; base to 6–8 cm diam., bright red. Sheath green or yellow-green with reddish blotches, red when young, glabrous. Ligule 12–13 mm, slightly emarginate, green. Petiole to 25 mm. Lamina narrowly elliptic, to 80 x 15 cm, dark green, with pale green midrib above; reddish or brownish beneath, margin undulating; average length to width ratio 4.8–5.4; base cuneate to $\pm$ auriculate. **Inflorescence** (including peduncle) 18–81(–120) cm, erect, receptacle 12–15 mm, with 38–49 flowers, 1–4 open at a time. Peduncle to c. 1 m, peduncular bracts not completely covering the green axis, uppermost enclosing spike, pale yellow-green. Spike 6–7 x 3–6 cm, cup-shaped, flowers only extending 5 mm above the bracts in very mature inflorescences. Sterile bracts: 5, to 6 x 3.5 cm, ovate-elliptic, pale

pink tinged green at base or darker red especially towards apex and with a pale margin, glabrous. Fertile bracts 3–6 x 0.9–3.5 cm, cucullate, tinged red, short-lived, glabrous (pubescent at the very base only). Bracteole to 2.5 cm, cream tinged red, with 2 fissures of 0.5–1.5 cm, apex bifid. **Flower:** calyx c. 4 cm, reaching beyond apex of anther and shorter than corolla lobes, red with yellow-green apex, fissured 2 cm, pubescent near base, apex 3-toothed, teeth close together. Corolla tube 2.5 cm, white, glabrous, tube inside densely hairy from point of attachment of dorsal lobe on the outside to base of anther and with distinct hairy cushions at point corresponding to lateral lobe attachment. Lobes reaching beyond stigma, dark burgundy red with white margin and apex; dorsal lobe 25 x 7 mm, cucullate, distinctly rigid mucronate; lateral lobes 22 x 6 mm, attached oblique, converging, 0–3 mm above dorsal lobe. Staminal tube 12 mm. Labellum narrowly ovoid, 17 x 15 mm, dark red, yellowish white in centre, margin yellowish white, central lobe extended 7.5 mm beyond anther. Stamen 11 mm long; filament 1.5 x 2 mm, cream; anther 9.5 x 3 mm, red; thecae dehiscing in upper half, margin hairy. Style 3.5 cm, with scattered hairs. Stigma 2.5 mm wide, purple, ostiole transverse elliptic, facing downwards. Ovary 3 x 3 mm; epigynous glands 3.5 mm, deeply bilobed, papillose. **Infructescence** to 12 x 10 cm, with 2–20 fruits per head, bracts not persistent; **fruit** yellowish green, pubescent, apex truncate to slightly depressed. Mature infructescence with **seeds** not seen in Java. *Plate 1E*.

Local names and uses: *Hondje burem* (Sundanese; referring to the leaves being red beneath; Poulsen *et al.* 2295). *Hunje leuweung* (Sundanese; Blume, 1827 — according to Valetton (1904) *leuweung* means wood; he considered *E. hemisphaerica* the wild origin of *E. elatior*). Heyne (1927) added the names *hondje hedjo* and *hondje laka* (based on what he called *Nicolaia atropurpurea*); these local names are also given for *E. elatior* and *E. solaris*, respectively.

Leafy shoot and fruit edible. According to Bakhuizen f. (1968), cultivated locally.

Etymology: The epithet means hemispherical, probably referring to the cup-shaped inflorescence.

Ecology and habitat: Primary and secondary lowland forests to 950 m. Fruits emptied by rodents.

Distribution: Sumatra, Java, and probably Peninsular Malaysia and Thailand. There are no definite records of this species from the wild in Borneo but it is cultivated at Tenom Agricultural Park in Sabah. A. Lamb (pers. comm.)

found it near Tenon and believes it was introduced by Javanese workers who came to work in the tobacco estates at about 1850 and took useful plants with them from Java.

Conservation status: VU B1ab(iii). Vulnerable by extent of occurrence estimated $<20,000 \text{ km}^2$, known from <10 locations, and decline in the extent and quality of lowland forest habitats in Java.

Additional materials examined: **Banten Province:** buffer zone of Ujong Kulon NP, Cikacang ($6^{\circ}48'S$ $105^{\circ}32'E$), 130 m, 28 Apr 2005, fruiting, *Poulsen et al.* 2347 (BO, E). **West Java Province:** Gunung Kancana, 2 km WSW of Parabuan village ($6^{\circ}55'S$ $107^{\circ}03'E$), 950 m, 27 Mar 2004, sterile, *Poulsen et al.* 2295 (AAU, BO); Gunung Tutupan, ($7^{\circ}22'S$ $106^{\circ}42'E$), 150 m, 11 Aug 2006, flowering and fruiting, *Poulsen et al.* 2460 (AAU, BO, E, L).

Notes: Amongst the *Etlingera* presently known in Java, *E. hemisphaerica* is most similar to *E. elatior* from which it differs in its erect bracts (not reflexed) and in having a lamina that is reddish beneath. Floral differences between the two species seem to be minor except for the anther possibly being longer in *E. hemisphaerica*, but more material is needed to test this.

With its leaves being wine-red beneath, *Etlingera pyramidosphaera* in Borneo appears very similar to *E. hemisphaerica* but the former differs in having a narrower inflorescence with fewer flowers, the anther thecae dehiscing for their entire length, and in its beaked fruits.

Bakhuizen f. (1968) described the fruits as globular or spindle-shaped, beaked. In the revision of *Etlingera* of Borneo, Poulsen (2006) emphasized the fruit shape as a reliable character. Thus, in the present account above, the fruit is described as globular — not beaked! More material will be necessary to establish if beaked fruits of *hemisphaerica*-like plants actually occur in Java, and if these plants deserve taxonomic recognition.

6. *Etlingera megalocheilos* (Griff.) A.D. Poulsen

Etlingera megalocheilos (Griff.) A.D. Poulsen, *Etlingera of Borneo* (2006) 167. **Basionym:** *Achasma megalocheilos* Griff., Not. Pl. Asiat. 3 (1851) 426, Ic. Pl. Asiat. 3 (1851) t. 355; Valeton, Icon. Bogor. 2 (1906) t. 188, t. 199 figs. 7–9; Heyne, Nuttige pl. Nederl. Indië 1 (1927) 489; Holttum, Gard. Bull. Singapore 13 (1950) 191, fig. 23; Burtt & Smith, Notes Roy. Bot. Gard. Edinburgh 31 (1972) 221, fig. 16. *Amomum megalocheilos* (Griff.) Baker, Fl. Brit. India 6 (1892) 236; Valeton, Bull. Inst. Bot. Buitenzorg 20 (1904) 44; Valeton, Icon. Bogor. 2 (1906) t. 188 figs. 1–8, t. 199 figs. 7–9; Bakhuizen f., Bekn. Fl. Java 18 (1958) 33; Bakhuizen f. in Backer, Fl. Java 3 (1968) 57. *Hornstedtia megalocheilos* (Griff.) Ridl., J. Straits Branch Roy. Asiat. Soc.

32 (1899) 146; Schumann, Pflanzenr. IV, 46 (1904) 199; Ridley, Matr. Fl. Mal. Penin. 2 (1907) 38; Ridley, Fl. Mal. Penin. 4 (1924) 270. **Type:** *W. Griffith s.n.* (specimen not found). Malaysia, Johore, Mt. Ophir, flowering in February.

- *Amomum rubroluteum* Baker, Fl. Brit. India 6 (1892) 236. *Etlingera rubrolutea* (Baker) C.K. Lim, Folia Malaysiana 2(3) (2001) 157. **Type:** *A.C. Maingay 1588* (holo, K), Malaysia, Malacca.

- *Etlingera littoralis* auct. non (J. König) Giseke: Smith, Notes Roy. Bot. Gard Edinburgh 43 (1986) 445; Lim, Folia Malaysiana 2 (2001) 149; Keng et al., Concise Fl. Singapore 2 (1998) 57; Khaw, Gard. Bull. Singapore 53 (2001) 235.

Rhizome long-creeping, subterranean (1.5–25 cm), stout, >2 cm in diameter, cream to pale brown, scales to 6 cm, brown, pubescent at base. **Leafy shoot** to 5 m, with up to 28 leaves; base to 8 cm in diameter, dark green. Sheath striate with some cross bars, especially in upper part of the shoot, glabrous, green when fresh. Ligule to 35 mm, entire, green or tinged reddish brown, glabrous or with a few scattered hairs, margin ciliate. Petiole 25–55 mm, glabrous. **Lamina** to 101 x 16 cm, oblong, broadest above the middle, mid- to dark green, pale beneath, young leaf tinged reddish, glabrous (rarely pubescent); average length to width ratio 3.5–7; base $\pm$ unequal; apex acute. **Inflorescence** (including peduncle) 9–18 cm, embedded in the soil, often some distance from base of leafy shoot, with 10–12 flowers, 2–5 open at a time. Peduncle 2–10 cm, subterranean, peduncular bracts cream, acute, shiny, glabrous. Spike to 10–12 x 2–3 cm, cylindrical, flowers extended 3–4 cm above the bracts, length only including bracts: 5–8 cm. Sterile bracts *c.* 5, loosely and spirally arranged, to 4–7 x 1.5–3.5 cm (upper longest and narrowest), ovate to broadly spatulate (widest above the middle), rigid, mucronate, cream tinged pink or bright red, densely pubescent at least in lower half. Fertile bracts 5–8.5 x 0.6–1.9 cm, linear to spatulate, semitransparent, white, pubescent in lower half; apex cucullate, ciliate. Bracteole 4.5–7 cm, pale pink, membranous, with two fissures of 1.5–2.5 cm, pubescent in lower half, apex 2-toothed, ciliate. **Flower:** Calyx 6.1–9 cm, almost reaching filament, $\pm$ as long as corolla lobes, white to pale red with pinkish apices, fissured 2.5–3.5 cm, pubescent in lower 1/4; apex irregularly 3-toothed, tufted. Corolla tube 5.8–8 cm, pale red, darker at apex, glabrous, tube hairy inside especially in a 10 mm band ending 10 mm from labellum. Lobes pale red or pink, glabrous, delicately membranous; dorsal lobe 21–30 x 7–9 mm, reaching near middle of anther (but pushed to the side by the lateral lobes of labellum leaving the anther $\pm$ exposed), elliptic, broadest below middle, apex slightly ciliate; lateral lobes 21–25 x 4.5–5 mm, linear-elliptic, broadest below middle, apex

slightly ciliate; insertion oblique, converging, 0–3 mm above dorsal lobe. Staminal tube 12–22 mm; labellum hourglass-shaped, 52–70 x 20–22 mm, plain red or red to orange–red with yellow margin, with a longitudinal central ridge, glabrous, lateral lobes erect, adhering to sides of anther, base slightly auriculate, central lobe 40–48 x 17 (measured from apex of anther and when flattened), spatulate, entire or emarginate (to 1.5 mm), margin recurved, apex extended 35 mm beyond anther. Stamen 17 mm; filament 4–7 x 4–5 mm, slightly hairy on outside, pale red; anther 10–11.5 x 5–5.5 mm, broadest at apex, emarginate 1.5–2.5 mm, slightly angled 135–160°, red, darker at crest; thecae dehiscent in upper 1/2–2/3, glabrous with a few hairs at the base. Style 8.5–9.5 cm, glabrous to very sparsely hairy adaxially near apex. Stigma 3–4 mm wide, rounded-triangular with a rounded back, pale or dark red; ostiole transverse, 2.5–3 mm, facing downwards or forwards, perhaps flexistylous. Ovary 3–6 x 3–4 mm, densely hairy; epigynous gland 5–9 mm, deeply bilobed or bipartite, apex sometimes hairy. **Infructescence** embedded in the soil, head *ca* 5 x 7–8 cm, bracts not persistent; **fruit** 2.5–3.5 cm across, rounded, not ridged, sometimes slightly warty at apex, pale brown or pink, densely pubescent. **Seeds** up to 4 mm across, angular. *Plate 1F*.

Local names and uses: *Tepus* (Sundanese; Heyne, 1927). The smell is variable; at least in Borneo (Poulsen, 2006) and in Sumatra the smell is strong and somewhat unpleasant, similar to *E. foetens*.

According to Heyne (1927), *E. megalocheilos* was not cultivated but the fruits searched for in the wild and eaten.

Etymology: The epithet refers to the large labellum.

Ecology and habitat: Often dominant in forest gaps or completely open areas to 1300 m.

Distribution: Malay Peninsula, Singapore, Sumatra, Java, and Borneo.

Conservation status: Least concern (LC). Bakhuizen f. (1968) thought it scarce everywhere, but I have observed it in several very open habitats and consider it rather resilient to disturbance. It may actually have expanded in recent years.

Additional materials examined: **Banten Province**, Ujung Kulon NP, Cibayoni (6°41'S 105°35'E), 100 m, 26 Apr 2005, flowering, *Poulsen et al.* 2341 (AAU, BO, E). **West Java Province**, Cibabi (7°18'S 106°24'E), 50 m, 12 Aug 2006, flowering, *Poulsen et al.* 2461 (BO, E).

Notes: Etlingera megalocheilos is most easily confused with *E. coccinea* that also has the inflorescence embedded in the soil and an elongate, red and yellow labellum. But in *E. megalocheilos* the anther is not covered by the corolla lobe, the margins of the labellum are not inrolled, and the labellum is red with more or less pale red or yellowish lateral lobe margins (not yellow with red margins).

Griffith (1851) described *Achasma megalocheilos* from Peninsular Malaysia – a taxon also mentioned by Ridley (1899), Holtum (1950), and which Khaw (2001) called *E. littoralis* following Burtt and Smith (1986).

I have not encountered fruits of *E. megalocheilos* in Java but those I have seen from Borneo (Poulsen, 2006) and Sumatra and also described by Holtum (1950) match Valeton's (1906) description and illustrations of the fruits of *A. megalocheilos* which are rounded and smooth but with a few warty protuberances near the top, based on material from Malabar Mts., Java.

7. *Etlingera solaris* (Blume) R.M. Sm.

Etlingera solaris (Blume) R.M. Sm., Notes Roy. Bot. Gard. Edinburgh 43 (1986) 249; PROSEA 13 (1999) 254. **Basionym:** *Elettaria solaris* Blume, Enum. pl. Javae (1827) 52. *Alpinia solaris* (Blume) D. Dietr., Syn. pl. 1 (1839) 12. *Nicolaia solaris* (Blume) Horan., Prodr. Monogr. Scitam. (1862) 32; Heyne, Nuttige pl. Nederl. Indië 1 (1927) 488; Bakhuizen f., Bekn. Fl. Java 18 (1958) 45; Bakhuizen f. in Backer, Fl. Java 3 (1968) 63. *Cardamomum solare* (Blume) Kuntze, Revis. gen. pl. 2 (1891) 687. *Amomum solare* (Blume) K. Schum., Bot. Jahrb. Syst. 27 (1899) 308; Valeton, Icon. Bogor. 2 (1906) t. 160 figs. 15, 13–15, t. 165 figs. 6–12, 16; *Phaeomeria solaris* (Blume) K. Schum., Pflanzenr. IV, 46 (1904) 264. **Type:** *C.L. von Blume s.n.* (L).

- *Elettaria pallida* Blume, Enum. pl. Javae (1827) 52. *Alpinia pallida* (Blume) D. Dietr., Syn. pl. 1 (1839) 12. *Nicolaia pallida* (Blume) Horan., Prodr. Monogr. Scitam. (1862) 32. *Cardamomum pallidum* (Blume) Kuntze, Revis. gen. pl. 2 (1891) 687. *Phaeomeria pallida* (Blume) K. Schum., Pflanzenr. IV, 46 (1904) 264. **Type:** *C.L. von Blume s.n.* (holo L), Java.

Rhizome short-creeping (10–20 cm between closest pairs of leafy shoots), 4 cm diameter, scales dehiscent, brownish, papery. **Leafy shoot** 5 m; base to 5–7 cm diameter, brownish. Sheath: lower caducous, brownish; upper yellowish green with pubescent reticulation. Ligule 40–80 mm, membranous, caducous, deeply bilobed. Petiole 15–20 mm. **Lamina** to 83 x 19 cm, narrowly elliptic or obovate, slightly plicate, dull mid-green, midrib yellow-green, pale green with yellow-green midrib beneath, glabrous; average length to width ratio 3.25–5.25; base ± unequal, cuneate. **Inflorescence** (including peduncle)

to 50 cm, prostrate or ascending to erect, receptacle 3–8 cm (longest in infructescence), with numerous flowers, *ca* 10 open at a time. Peduncle to 40 cm, peduncular bracts, upper as long as lowest sterile bracts, to 9 x 3–4 cm. Spike 11 x 12 cm, globose, robust, flowers not extending above the bracts. Sterile bracts: lower 7–8 x 2–4 cm, with membranous margin and conspicuous apex (to 25 mm with inrolled margin, horn-like twisted towards centre of inflorescence), red soon turning brown, densely pubescent especially at base and margin. Fertile bracts to 5–7 x 1–1.2 cm, similar in shape to sterile bracts, orange-red. Bracteole 4–6 cm, with red apex, one long fissure to 5–15 mm above base; sometimes a second fissure for 5 mm only, densely pubescent throughout, apex bifid with 2 mucro (thus sometimes appearing 3-toothed). **Flower:** calyx 4.5–6 cm, reaching to apex of anther and beyond corolla lobes, red, fissured 3 cm, pubescent, apex 3-toothed 5–9 mm. Corolla tube 3–4 cm, $\pm$ pubescent in lower half, tube inside with an opposite V-shaped hairy cushion coinciding with dorsal corolla lobe attachment and a V-shaped one coinciding with the lateral lobes on the outside, *ca* 22 mm below labellum. Lobes orange-red, with scattered hairs; dorsal lobe 25–26 x 3–3.5 mm, linear, apex acute, reaching to base of anther; lateral lobes 23 x 2–3 mm, linear, insertion oblique, diverging, 3 mm below dorsal lobe. Staminal tube 17–22 mm. Labellum rounded triangular to ovate, 20–23 x 20 mm, orange-red; lateral lobes, margin yellow, central lobe extended 4–8 mm beyond anther, margin curved outwards. Stamen 16 mm: filament 2–3 mm x 3–3.5 mm, white to pale red; anther 13–14 x 3.5 mm, linear, $\pm$ erect, red, anther crest bilobed; thecae dehiscent in upper half 4–5 mm to 2 mm below apex, pubescent. Style 5–5.5 cm, with scattered hairs. Stigma 3–3.5 mm wide, dark purple, heart-shaped with scattered hairs; ostiole transverse, facing down- or forwards (possibly flexistylous); ovary 5–8 x 5 mm, pubescent. Epigynous glands 4–4.5 mm, with one incision, apex irregular, bilobed, margin curved inwards. **Infructescence** lying on ground (because of the heavy fruits), head 20 x 20–25 cm, globose, bracts persistent (at least the bases); **fruit** 10 x 4 cm, angularly obovoid, beaked, (broadest *ca* 4 cm from base), 3- to 6-sided, with persistent calyx, red and juicy when ripe, pubescent. **Seeds** 4 mm diameter, rounded. *Plate 1 G.*

Local names and uses: *Hondje warak* (Sundanese: Blume, 1827; Poulsen *et al.* 2297), *honje laka*, *honje gosser* (Heyne, 1927). Fruit edible.

Etymology: The epithet means sun-like probably referring to the inflorescence at anthesis. In the Mountain Flora of Java, van Steenis (1972) mentions *E. solaris* as "earth sun".

Ecology and habitat: Montane forests near streams at 800–1750 m.

Distribution: Sumatra, W Java as far east as Gunung Merapi in Central Java.

Conservation status: VU Blab(iii). Vulnerable by extent of occurrence estimated $<20,000 \text{ km}^2$ of montane forest, known from <10 locations, and decline in extent and quality of habitat.

Additional materials examined: **West Java Province:** Halimun NP, Citalahab ($6^{\circ}44'S$ $106^{\circ}31'E$), 1100 m, 21 Mar 2004, flowering and fruiting, *Poulsen et al.* 2285 (AAU, BO, E, L); Gede-Pangrango NP, Cibodas ($6^{\circ}45'S$ $107^{\circ}59'E$), 1750 m, 28 Mar 2004, flowering and fruiting, *Poulsen et al.* 2297 (AAU, BO).

Notes: The peduncle of *Etlingera solaris* is variable in position and direction but the species is easily recognized by the long and deeply bilobed ligule and the horn-shaped, twisted, pubescent bracts. Valeton (1921a, p. 137, plate 6) described *E. solaris* var. *aurantiaca* from Gunung Salak, Java. The variety is supposed to have an erect inflorescence to 20 cm (not procumbent), shorter teeth to the calyx and the lip orange rather than dark red, and possibly the same as *Elettaria pallida* Blume. I have seen this at Halimun and agree with Bakhuizen f. (1968) that it is hardly different. A collection (*Poulsen 2418*) from Gunung Kerinci, Sumatra, had its inflorescence embedded in the ground as the peduncle was subterranean, the stamen was shorter (13–14 mm) but the anther dehiscence matched that in the Javanese material.

Amomum chrysocalyx K. Schum. was listed as a synonym by Bakhuizen f. (1968) but, after inspecting its type, I am convinced that it has no relevance to *E. solaris*.

Incompletely Known Species

8. *Etlingera heyniana* (Valeton) R.M. Sm.

Etlingera heyniana (Valeton) R.M. Sm., Notes Roy. Bot. Gard. Edinburgh 43 (1986) 246. **Basionym:** *Nicolaia heyniana* Valeton, Bull. Jard. Bot. Buitenzorg ser. 3, 3 (1921) 132; Heyne, Nuttige pl. Nederl. Indië 1 (1927) 488. *Phaeomeria heyniana* (Valeton) Burkill, Bull. Misc. Inform. (1935) 318. *Amomum heynianum* (Valeton) Bakhuizen f., Bekn. Fl. Java 18 (1958) 31; Bakhuizen f. in Backer, Fl. Java 3 (1968) 56. - **Type:** Sentiong, Jakarta, cemetery, possibly cultivated, Nov 1918, *K. Heyne s.n.* (holo, BO).

No recent material has been seen and the modified description below is only a summary of what is presented by Valeton (1921a) and Bakhuizen f. (1968).

Leafy shoot to 4 m. Sheath glabrous. Ligule *ca* 8 mm, elliptic, obtuse, glabrous, stout. Petiole to 5 mm. **Lamina** 19–28(–65) x 4.5–5.5(–17) cm, narrowly

obovate, glabrous throughout; length to width ratio 4–6; base acute; apex shortly caudate-acuminate; margin glabrous. **Inflorescence** fusiform, red: receptacle discoid, with <20 flowers (estimated from Valeton, 1921a, Plate 3), *ca* 4 open at a time. Peduncle short, curved, scales obovate, glabrous, red, apex rounded, mucronate. Spike $\pm$ ovoid, only including bracts: to 5.5 x 0.5–1 cm. Sterile bracts 5.5–6.5 x 3 cm, oblong. Fertile bracts to 2–5.5 x 0.5–1 cm. Bracteole *c.* 4 cm, glabrous. **Flower**: calyx 5 cm, glabrous, 3-toothed. Corolla lobes 25 x 5 mm, linear. Labellum 3 x 1.5 cm long, with about equal elliptic upper and lower halves separated by a distinct constriction, red with yellow margin; central lobe *ca* 10 mm wide, margin slightly curled. Filament 7 mm; anther *ca* 10 mm, crest bilobed, divergent. Style glabrous. Stigma discoid, ostiole transverse; ovary pubescent. Epigynous glands 4 mm. **Infructescence** unknown.

Local names and uses: *Hondje* (Heyne, 1927). Valeton (1921a) noted that the entire plant is strongly aromatic like *Nicolaia speciosa* (*E. elatior*).

Etymology: The epithet is in honour of the Dutch botanist Karel Heyne (1877–1947) who collected in Java and Sumatra.

Ecology and habitat: Unknown. Seems to tolerate growing in a rather open habitat.

Distribution: Java.

Conservation status: Unknown.

Notes: The illustration of *Etlingera heyneana* in Valeton (1921a, Plate 3) looks to me more like an inflorescence of *E. megaloscheilos* where the flowers have not fully opened yet, similar to what may be observed in *E. nasuta* (K. Schum.) R.M. Sm. in Borneo. Apart for the labellum being erect and significantly shorter in *E. heyneana*, there are not strong evidence to separate them. At least the colours of the labellum (red with yellow margin) are the same. The type at BO mentions Gunung Honje as the locality – not Sentiong. I thus went to one G. Honje, of which locality there might actually be several in Java. At the locality I visited near Ujung Kulon, *E. megaloscheilos* was very common. A closer study of the floral development of this species may be fruitful.

Even though Valeton (1921a) mention the distinct smell of *E. heyneana*, this is not strong evidence against the possibility of synonymy with *E. megaloscheilos*, as in Sumatra I have experienced that it may sometimes

have a strong smell.

9. *Etlingera walang* (Blume) R.M. Sm.

Etlingera walang (Blume) R.M. Sm., Notes Roy. Bot. Gard. Edinburgh 43 (1986) 251; PROSEA 13 (1999) 254. **Basionym:** *Donacodes walang* Blume, Enum. pl. Javae (1827) 55. *Alpinia walang* (Blume) D. Dietr., Syn. pl. 1 (1839) 13. *Elettaria walang* (Blume) Miq., Fl. Ned. Ind. 3 (1859) 603. *Cardamomum walang* (Blume) Kuntze, Revis. gen. pl. 2 (1891) 687. *Achasma walang* (Blume) Valetton, Bull. Inst. Bot. Buitenzorg 20 (1904) 93. *Amomum walang* (Blume) Valetton, Bull. Inst. Bot. Buitenzorg 20 (1904) 44; Valetton, Icon. Bogor. 2 (1906) t. 162 figs. 1–9; Bakhuizen f., Bekn. Fl. Java 18 (1958) 32; Bakhuizen f. in Backer, Fl. Java 3 (1968) 56. *Hornstedtia walang* (Blume) Koord.-Schum., Syst. Verz. 1 (1911) 21. **Type:** Java, *C.L. von Blume s.n.* (holo, L).

- *Elettaria glaberrima* Zoll. & Moritzi, Syst. Verz. (1845–1846) 84. *Cardamomum glaberrimum* (Zoll. & Moritzi) Kuntze, Revis. gen. pl. 2 (1891) 686. **Type:** *H. Zollinger 670* (isotypes, BM, K, L, P).

No recent material has been seen and the description below is only a summary of what is presented by Valetton (1904; 1906) and Bakhuizen f. (1968).

Rhizome slender. **Leafy shoot** 1.5–2 m. Sheath glabrous. Ligule c. 10 mm, finely ciliate, otherwise glabrous, stout. Petiole 5–10 mm. **Lamina** 29–49 x 5–6.5 cm, narrowly obovate, glabrous throughout; average length to width ratio 6–7.5; base $\pm$ unequal, narrowly cuneate; apex shortly acuminate, finely hairy; margin glabrous. **Inflorescence:** receptacle almost flat, with <20 flowers, c. 3 open at a time. Peduncle to 8 cm, subterranean, scales to 5 x 1.3 cm, mucronate, finely longitudinally veined. Spike ovoid-cylindrical, only including bracts: to 7 x 2.5–3.5 cm; about 5 sterile bracts, narrowly obovate, acuminate, mucronate: to 6–8 x 1.3 cm. Fertile bracts to 6 cm, narrower than sterile bracts. Bracteole c. 5 cm, bifid, densely pubescent at least in lower half. **Flower:** calyx as long as corolla, irregularly 3-toothed. Corolla red; lobes erect, oblong, dorsal lobe longest. Labellum yellow with red margin; lateral lobes, margin curved upwards and conspicuously crenate, central lobe 5 cm long, narrow, ligulate-spathulate, deeply bilobed. Filament 7 mm; anther ca 10 mm, crest bilobed, divergent. Style 5.5 cm, hairy below apex. Stigma triangular, hairy; ovary pubescent. Epigynous glands 4 mm. **Infructescence** unknown.

Local names and uses: *Walang* (Sundanese). Leaves are served as a side dish with rice (Valetton, 1904), as a condiment, or the leaves are burnt on rice fields as an insect repellent (Heyne, 1927).

Etymology: The epithet refers to the bad-smelling rice bug, *walang sangit* (*Leptocorisa acuta* Thunb. or *L. varicornis* Fabr.). Bakhuizen f. (1968) noted that all parts – especially the leaves — are ill-smelling.

Ecology and habitat: forests to 1200 m, and cultivated.

Distribution: Java.

Conservation status: Impossible to assess.

Notes: In Blume's protologue (1827) of *Etlingera walang* he placed a question mark after the genus (*Donacodes*). All that is reported of the new species is that the leaves are elongate-linear-lanceolate, acuminate, and glabrous, and it appears he had not seen the flowers. I think the question mark refers to the uncertainty of which genus to place it in, but, without the flowers, one has to wonder why Blume placed it in *Donacodes* (the remaining species of which are presently placed in *Hornstedtia*).

Valeton (1904) did detailed studies around Bogor where he found that *E. walang* was 'one of the most economically important Sundanese plants' and often cultivated, of unknown origin and very easily recognized by its characteristic smell that stays for months with the specimen after drying. He studied the inflorescence in detail (see plate in Valeton, 1906) and thought it was much more narrow than that of *E. coccinea* and *E. foetens* but that these three species formed a natural group and apart from the crenate margin to the labellum, *E. walang* was very similar to *E. coccinea*.

In my opinion what Valeton illustrated is just an *E. coccinea* with a deeply bifid apex to the labellum, similar to *Poulsen et al.* 2343 from Ujung Kulon. It is important to remember, however, that the basis for Valeton's descriptions (1904; 1906) and illustrations (1906; Plate 162, figs. 1–9) are not based on the type.

The issue of smell is, however, very interesting. As mentioned in the notes above on *E. coccinea*, in Borneo a very smelly form of this species – also of unknown origin – is often cultivated and commonly sold in the markets.

More detailed surveys around Bogor may result in the discovery of *walang* and it would then be possible to establish if this just a form of *E. coccinea*.

Conservation of *Etlingera* in Java

None of the seven well-known species of *Etlingera* is endemic to Java. They all display geographical affinity with nearby Borneo or Sumatra to the north and west, but no overlap with species in Wallacea to the east.

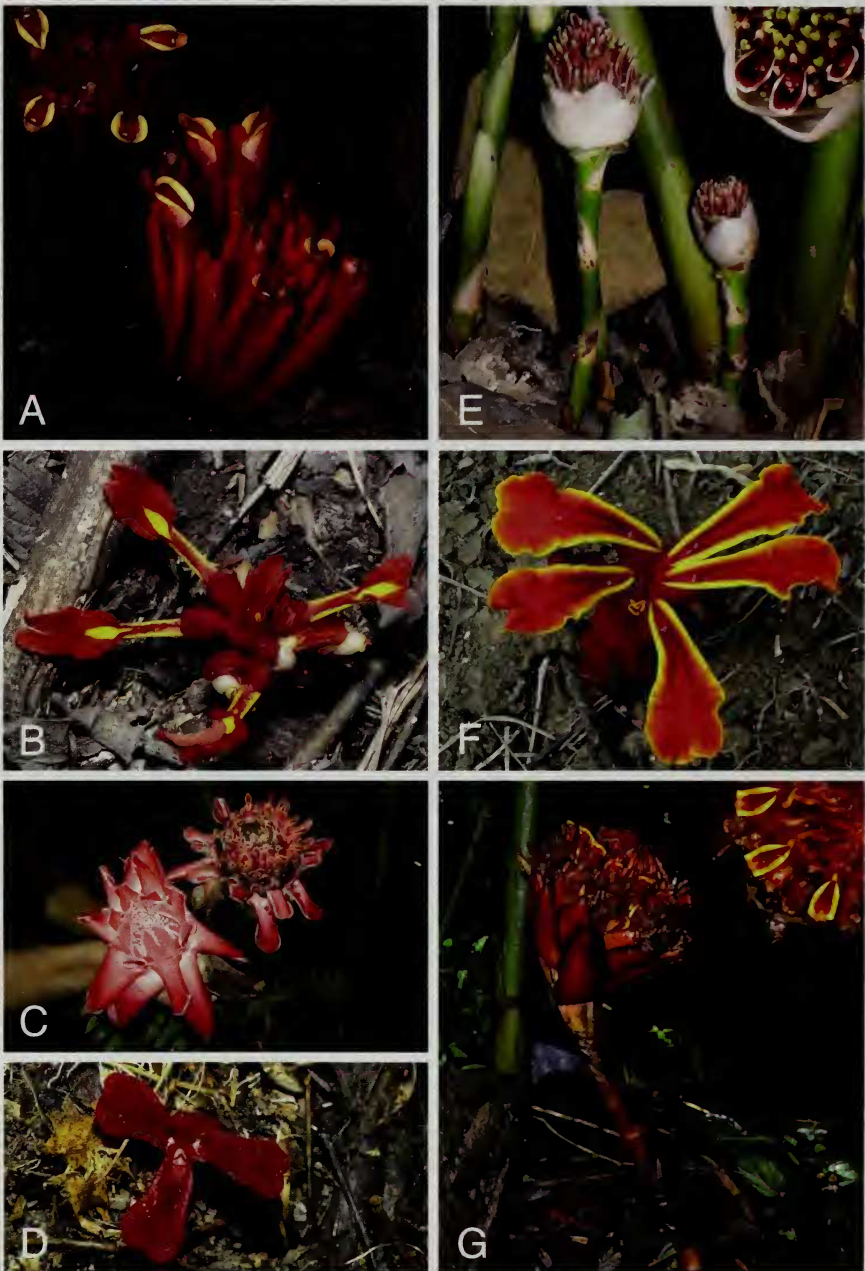


Plate 1. Photographs of Javanese *Etlingera* species. A. *E. brachychila*. Ujung Kulon, Banten Province (Funakoshi IU 19) by H. Funakoshi; B. *E. coccinea*. Cikaso, W Java Province (Poulsen et al. 2458) by A.D. Poulsen; C. *E. elatior*. Batang Gadis NP, North Sumatra Province (not collected) by Lis Maidi Darjo; D. *E. foetens*. Bau, Sarawak, Borneo (Poulsen et al. 1894) by A.D. Poulsen; E. *E. hemisphaerica*. W Java Province (Poulsen et al. 2460) by A.D. Poulsen; F. *E. megalochelos*. Baduy Territory, Banten Province (not collected) by M. van Heist; G. *E. solaris*. Halimun NP, W Java Province (Poulsen et al. 2285) by A.D. Poulsen.

Two of the species (*E. coccinea* and *E. megaloscheilos*) seem to be common in very disturbed habitats and there is no great concern for their conservation. However, there is reason to fear the future survival in Java of *E. brachychila*, *E. foetens*, *E. hemisphaerica*, and to a lesser extent, of *E. solaris*.

Acknowledgements

I thank the Indonesian Institute of Sciences (LIPI) for permission to conduct research in Java; the Herbarium Bogoriense and its Directors and staff for logistic and other support, especially Marlina Ardiyani, Deden Girmansyah, Ismail Rachman, Agus Sayadi, Aden Muhidin, and Alex Sumadijaya; The National Parks Service of Halimun, Gede-Panggrango, and Ujung Kulon; the local people in W Java for assistance in the field; H. Funakoshi for sharing his important material of *Etlingera brachychila* with me; The National Parks of Singapore for funding my journey to Asia in 2006; The Royal Botanic Garden Edinburgh for providing facilities and contributing to the fieldwork in Java in 2006; Mark F. Newman for giving constructive comments on an earlier stage of this paper; Hidetoshi Funakoshi, Lis Maidi and Miriam van Heist for letting me use their images; and the Carlsberg Foundation, Denmark, for a senior research stipend.

References

- Bakhuizen van den Brink, R.C. 1958. *Beknopte Flora van Java* **18**.
- Bakhuizen van den Brink, R.C. 1968. Zingiberaceae, pp. 41–76. In: C.A. Backer & R.C. Bakhuizen van den Brink, *Flora of Java*, vol. **3**. N.V.P. Noordhoff, Groningen, The Netherlands, 761 pp.
- Blume, C.L. 1827. *Enumeratio Plantarum Javae et insularum adjacentium*. J.W. van Leenwen.
- Burt, B.L. and Smith, R.M. 1986. *Etlingera*: the inclusive name for *Achasma*, *Geanthus* and *Nicolaia* (Zingiberaceae). *Notes from the Royal Botanic Garden Edinburgh* **43**: 235–241.
- Griffith, W. 1851. *Notulae ad plantas Asiaticas*, vol. **3**. Calcutta.
- Heyne, K. 1927. Zingiberaceae, pp. 473–504. In: De nuttige planten van Nederlandsch Indië **1.2nd** edition. Department van Landbouw, Nijverheid en handel in Nederlandsch Indië.

- Holttum, R.E. 1950. The Zingiberaceae of the Malay Peninsula. *The Gardens' Bulletin Singapore* **13**: 1–249.
- IUCN 2000. *IUCN Red List Categories and Criteria*. Version 3.1.
- Kato, M., Itino, T and Nagamitsu, T. 1993. Melittophily and ornithophily of long-tubed flowers in Zingiberaceae and Gesneriaceae in West Sumatra. *Tropics* **2**: 129–142.
- Khaw, S.H. 2001. The genus *Etlingera* (Zingiberaceae) in Peninsular Malaysia including a new species. *Gardens' Bulletin Singapore* **53**: 191–239.
- Poulsen, A.D. 2006. *Etlingera of Borneo*. Natural History Publications (Borneo), Kota Kinabalu, Malaysia & Royal Botanic Garden Edinburgh, Scotland, 263 pp.
- Ridley, H.N. 1899. The Scitamineae of the Malay Peninsula. *Journal of the Straits Branch of the Royal Asiatic Society* **32**: 85–184.
- Sakai, S., Kato, M. & Inoue, T. 1999. Three pollination guilds and variation in floral characteristics of Bornean gingers (Zingiberaceae and Costaceae). *American Journal of Botany* **86**: 646–658.
- Smith, R.M. 1986. A review of Bornean Zingiberaceae: II (Alpineae, concluded). *Notes from the Royal Botanic Garden Edinburgh* **43**: 439–466.
- Schumann, K.M. 1904. Zingiberaceae. In: A. Engler, *Das Pflanzenreich IV*, **46**: 1–458.
- Valeton, T. 1904. Ueber neue und unvollständig bekannte Zingiberaceae aus West-Java und Buitenzorg. *Bulletin de l'Institut Botanique de Buitenzorg* **20**: 1–99.
- Valeton, T. 1906. *Icones Bogoriensis*, vol.2. Leiden.
- Valeton, T. 1921a. *Nicolaia* Horan. Description of new and interesting species. *Bulletin Jardin Botanique Buitenzorg* **3**: 128–140.
- Valeton, T. 1921b. *Rhynchanthus* Hook. f., *Geanthus* Reinw. and *Geostachys* Ridl. *Bulletin Jardin Botanique Buitenzorg* **3**: 141–147.
- van Steenis, C.G.G.J. 1972. *The mountain flora of Java*. E.J. Brill, Leiden.